

MARINE REVIEW.

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No. 15.

A Loss to Lake Interests.

A correct portrait of Col. O. M. Poe, from the latest photograph is presented herewith. Nothing more than a sketch could be presented last week on account of lack of time. Vessel owners who knew him will want to know more of his life than was contained in the brief account published last week. During the funeral services last Saturday the lock at Sault Ste. Marie was closed for two hours by order of the secretary of war. It was a touching tribute of respect, for owing to fidelity to duty of the dead engineer the lock was seldom closed and when anything did happen he hardly slept until it was in order again and the commerce whose magnitude he well understood, was moving through the gateway, the public works of which will remain a monument to him for many years.

1884, he was put in charge of lake improvements. Had he not appreciated the fact that cheap water transportation was a national and not a sectional benefit his adverse recommendations could have hampered lake commerce and held it back from its present magnitude for at least a decade. But it is not claiming too much to say that he has hastened by his co-operation in all improvements its present condition by at least that many years. If he had lived until March 7, 1896, he would have reached the age of retirement, but the Lake Carriers' Association was preparing to petition congress to retain him in his present position until the completion of the new Sault lock and the 20-foot channel, the two greatest public works ever undertaken by the government in connection with lake commerce, both of which were planned and pushed for-



He was born in 1832 at Morane, Stark county, Ohio, and graduated from West Point in 1856. From 1860 until the breaking out of the war he performed lake survey duty. His war record shows a continual advancement until he was brigadier general of volunteers. He was in the battle of Gettysburg and commanded a division of the ninth army corps, and was chief engineer with Sherman in his march to the sea. He was brevetted for meritorious service during the surrender of Johnston. Then for five years he was engineer secretary of the light-house board, engineer of the upper lakes light-house district to 1873, colonel of staff and aide-de-camp to Gen. Sherman for a year, and then for several years was member of the light-house board, board of army engineers, and was detailed for various important duties in connection with the different river and harbor works throughout the country. In April,

ward under his commands. A prominent army officer in Washington says of him: "He was considered one of the best engineers of the United States." His scrupulous honesty is illustrated by the following instance: A wealthy friend of the general's once called his attention to a certain point on the shore of a body of water that his business instincts told him would make a good investment. He invited the general into partnership to buy, but was refused. The general claimed he had no money. The friend persisted, and offered, to loan him the funds, but met with the same answer. The friend insisted on learning the reason, and was finally informed, after some persuasion, that the general was about to recommend to congress the improvement of the surrounding waterways at the cost of the government, and could not take advantage of the value added to the property by this improvement.

Lake Freights Steadily Advancing.

Official figures covering the ore movement from all shipping ports have been received by the Cleveland Ore Shippers Association. Shipments by ports are not given out but the aggregate figures are 8,105,212 tons to October 1. This would leave less than 1,000,000 tons to come down from now until the close of navigation, to make the season's shipments 9,000,000 tons. This is what conservative men in the business have accepted as the probable movement. This would mean a very light movement and may prove quite a factor in determining whether the present rates shall be maintained on an ore basis or a grain basis.

Anything written about lake freights these days wants to be published while it is warm or else it is worthless. For the first time in four years there is a scarcity of tonnage. Freights are reaching the figures paid in November, 1891, but with the advantage of two months of navigation as against one then. There is also more grain and coal to be moved than there was in that year, although the large increase in tonnage must be considered.

Nov. 5, 1891, freights were: Duluth wheat, 5 cents; Chicago wheat, 3½ cents; Escanaba ore, \$1.10; Ashland ore, \$1.50; Milwaukee coal, 65 cents; Lake Superior coal, 40 cents.

Nov. 12, 1891, freights were: Duluth wheat, 7½ cents; Ashland ore and Marquette ore, \$1.40; Escanaba ore, \$1.30; Milwaukee and Chicago coal, 85 cents and \$1; Lake Superior coal, 40 cents.

Nov. 19, 1891, freights were: Duluth grain, 8 cents; Lake Superior coal, \$1; Milwaukee coal, \$1.25; Marquette ore, \$1.40; Escanaba ore, \$1.30.

At the close ten cents was secured on a few boats for wheat from Duluth to Buffalo.

It can be seen that Chicago grain dropped out of competition early in the month and that Duluth wheat was the back-bone of the advance. Ore did not cut much of a figure, and if it is true that deals have been made with the furnaces to hold over orders until spring, that will not break the combination, but from the present outlook the furnaces will want everything they contracted for, and some fancy prices may be paid for bringing ore from the head of the lakes. In the absence of detailed figures from the Canadian canal, telling just how much grain passed down that way, the American lock figures showing a shortage of 1,500,000 bushels over last year's shipments to Oct. 1, are not satisfactory, although very little grain is thought to have gone that way. There is certainly much more grain to come than last year and there seems to be no condition upon which the present prosperous condition of freights will go to pieces. Thursday morning the situation was as follows: The Duluth grain rate is strong at 5 cents, and even A 2 boats were taken at that; 4 cents was paid on corn at Chicago; \$1.75 has been paid from Two Harbors to Buffalo, and although \$1.50 still stands for the head of the lakes ore rate, nothing is doing and when anything more is done it will be at \$1.60; as an evidence of this note how the Escanaba rate went up 25 cents in two days, making it \$1.25; and in all cases there is a scarcity of boats.

It is very vigorously denied that the Harper, Nimick and Tyrone have been placed for next season at \$1 a ton from the head of the lakes.

Ship Yard Work.

The contract placed by the Niagara Navigation Co., with the Bertram Engine Works, Toronto, is for a steamer of the side-wheel passenger boat, type, having three decks, and is only intended for day service. The steamer will be 277 feet over all, 269 feet on the water line, 32 feet beam, 59 feet 2 inches over guards, and 13 feet 6 inches moulded depth. The hull is to be built of steel throughout; the engines are compound condensing, of the inclined type, with cylinders 45 inches and 85 inches by 5 feet 6 inches stroke, turning paddle wheels 22 feet diameter. The boilers are six in number, of the gun-boat type, each boiler 8 feet diameter by 16 feet long, having two furnaces 37 inches diameter. There will be two fire holds, three boilers to each fire hold; and two smoke stacks. The deck arrangements, and the cabins, have been laid out by the designer to suit the particular business for which the steamer is built, that is to ply as a day boat between Toronto, Niagara and Lewiston. The designs for the steamer, submitted by the Bertram Engine Works Co. and approved by the Niagara Navigation Co. are by Mr. A. Angstrom, engineer and naval architect, the general manager of the Bertram Co. It will be remembered that Mr. Angstrom has had considerable experience with designs for the best type of steamers of this class while engaged with the Fall River Line of Boston, Mass., on designs for the magnificent steamers Puritan and Plymouth. The Bertram Co. has also contracts for two side-wheel steamers 130 feet long by 26 feet beam, for the Upper Ottawa Improvement Co. to be used for lumber towing on the Upper Ottawa river.

Although Mr. Frank E. Kirby, who arrived in Detroit Sunday, did not bring back the big contract from the Russian government, it was not because some one else got it. Everything was running along nicely towards signing the contract with the Detroit Dry Dock Company, but in the last few weeks there has arisen a complication. This complica-

tion, or cause of the government's abandoning the plan of building the ferries, is the possible acquirement by Russia of the Manchurian province which Japan got from China in the late war. If this is accomplished the Russians will abandon the idea of making Vladivostok, in Siberia, the eastern terminus for the road, and give the honor to Port Arthur instead. "The route," says Mr. Kirby, "is beset with but slight difficulties, being open the year around, and going over no lakes or other bodies of water that need ferries. This is a very late condition, and it is possible it may fall through. If it does then the company will build the boats."

Concerning the matter of the bid for two naval vessels going to the Detroit Dry Dock Company, an officer of the bureau of construction says: "There is absolutely no foundation for the statement that the bid of the Detroit company will be thrown out. It is being considered with the others, and if found to be the lowest and best bid the contract will be awarded to that company. Even if the Detroit company should get the contract, however, the boats will not be built at Detroit. The company made its bid with the expectation of constructing the vessels, if the contract should be awarded to it, at Seattle, Wash. Secretary Herbert decided that under our treaty with Great Britain the boats could not be built on the lakes. The company then agreed, if awarded the contract, to construct them on the Pacific coast. I have no doubt an effort will soon be made to obtain such a modification of our treaty with Great Britain as will enable ship building companies on the lakes to enter the competitive lists on even terms with the other naval construction companies of the country. The matter has been discussed, and quite carefully considered, and I have no doubt that such a modification of the treaty can be affected."

Capt. James Davidson of West Bay City has completed the preliminary work and is now sawing out the material for a double-deck schooner for which he will lay the keel next week. She will be 300 feet long by 44 feet beam and 20 feet depth of hold, and will have a capacity of 2,600 gross tons of ore on a draft of 14 feet 3 inches. This schooner is the first of four large ships which Capt. Davidson will build on his own account this winter. He says he will also build three or four other boats on contract.

The new steamer decided upon for the Goodrich line will be 227 feet long over all, with 37 feet beam and 14 feet 6 inches hold. She is to be provided with a fore-and-aft compound engine, the cylinders to have 26 and 36 inches diameter and the stroke to be 36 inches. According to latest advices from Chicago the contract for building the hull is likely to be awarded to Burger & Burger of Manitowoc.

Settle all Claims During the Season.

In deciding the Nebraska case the United States court of appeals made important rulings in admiralty law. The winter preceding the World's Fair Edward Cummings bought the steamer Nebraska, which had been a freight carrier and had been converted into a passenger boat by the Milwaukee Ship Yard Company, at the expense of some \$15,000. The venture proved a losing one, and he gave the ship yard people a mortgage for the amount of their claim. During the season bills amounting to about \$13,000 were accumulated against the boat for fuel, wages and supplies, and she was libeled and sold for \$13,000. The Milwaukee Ship Yard Company, which bought the boat, endeavored to have its mortgage given the preference and the case went into the courts, the purchase money being deposited in the United States sub-treasury. The lower court decided against the mortgage, and this decision is now affirmed. The court decides that a maritime lien must be enforced during the current season in which it had been contracted. The Milwaukee ship yard, in accepting a mortgage running for a longer time, vitiated its lien. Hitherto on the lakes liens have had two seasons. The court also rules that a captain has no lien against his vessel for wages; that he is a representative of the owners, and is there to protect the owner's interests. Even if he does not collect the boat's earnings and has nothing to do with its financial operations, his wages are not a lien. This bars out Capt. Pringle, who had nearly an entire season's salary coming to him. The \$13,000 which has been lying in the sub-treasury for nearly two years will at once be divided among the creditors. The Milwaukee Ship Yard Co. will now institute suit against Hume, Galvin & Tyler of Buffalo, collectively and individually, for \$15,000, the amount of the mortgage they gave the ship yard to secure the release of the Nebraska when tied up in August, 1893. At that time Cummings had gone broke and the former owners stepped in and took the Nebraska back.

Le Forban, a new torpedo boat constructed at Havre for the French government, has just completed her official speed trials at Cherbourg. During the trials she accomplished 31 knots an hour, which is so far the highest actual speed recorded for this class of vessels. The Forban is 44 metres long and 4 metres 64 centimetres in beam. She had a displacement of 135 tons, and her engines are 3,250 horse power.

Around the Lakes.

Capt. Wm. Lent, old time vessel master, died at Conneaut last week.

The city of St. Joseph, Mich., has made a proposition to parties to locate a dry dock there.

Water was let into the new dry dock, last week, built by the Craig Ship Building Co. Toledo.

It is expected that new life saving stations at Plum Island and Bailey's harbor will be ready for occupancy about Nov. 1.

Edward T. Peck succeeds the late John C. Parker as superintendent of the Detroit Dry Dock Co.'s Orleans street ship yard.

Managers Collier and Elsey of Cleveland harbor tug lines have granted a demand from employes for an additional fireman on their boats.

The steamer Penobscot is credited with the distinction of having been the first vessel to navigate Hay lake channel by night with the aid of the new range lights.

In order to keep vessels moving Supt. Bell of the Marquette docks conceded to a demand by trimmers for a cent a ton extra, but vessels were charged the old price.

The American Steel Barge Company's new dock at West Superior has been kept so busy for several months that it has been decided to build another dock during the coming winter.

The wrecking tug Favorite worked on two wrecks at once this week. After leaving divers and carpenters on the Fryer in the Soo she went to Copper harbor and released the City of Paris.

The schooner Queen City ashore on Hay island has been stripped of everything valuable, even to the cabin stove by Beaver island inhabitants. A wreck is considered a providential means of support to these people.

The schooner Dauntless, owned by the Morton coal company of Hamilton, foundered off Thirty Mile point, on the south shore of Lake Ontario. She was bound from Charlotte, N. Y., to Hamilton, with 300 tons of coal.

An order was issued by the Welland canal authorities limiting the draft of vessels in the canal to thirteen feet. The normal draft is fourteen feet, but the reduction to thirteen feet six inches was made two months ago.

C. A. Macdonald & Co. of Chicago, representing underwriters holding risks on the steamer Mark Hopkins, sunk in the Sault river, will open bids on Sept. 7 for raising the vessel and cargo. "No cure, no pay" is the basis upon which bids are asked.

The contract for raising the steamer Mark L. Hopkins, was awarded by the underwriters to Henry McMoran of Port Huron for \$13,500. McMoran agrees to deliver the boat in dry dock, and take the boat for his pay if desired. If he fails he gets nothing.

Capt. Robert McLeod of the steamer Colorado has accepted command of the Conneaut car ferry Shenango No. 1, and will be succeeded in the Colorado by Capt. Boyd McLeod, who leaves the Osceola. John McLane, mate of the steamer Cadillac, takes the Osceola.

It is understood that the wooden steamer Geo. W. Roby, recently taken by F. W. Wheeler & Co. in part payment for a new steel steamer, can be bought for \$90,000. At \$110,000 for a Davidson boat like the City of Glasgow, it would seem that the Roby is a bargain.

Two lake vessels were officially numbered by the Bureau of Navigation, Treasury Department during the week ending Sept. 28: Sail, Dalla, Grand Haven, Mich., No. 157,435, tonnage, gross and net 897. Steam, E. T. Douglass, Buffalo, N. Y., No. 186,522, tonnage, gross 137.20, net 93.30.

Capt. Hugh Reynolds, formerly surfman in the Sand Beach life saving station, and later mate in the Parks Foster, died in Bay City this week. He owned the Germania and was interested with Farasey and Marron in a Cleveland-Saginaw Valley transportation arrangement. He was 30 years old.

It is stated the position of marine superintendent of the Northern Steamship Company, made vacant by resignation of J. H. Killoran, will go to Capt. Wesley Brown, this season of the North West. He is a perfect gentleman and will, no doubt, fill the position with credit to himself and the company.

A novel method of preventing sinking through collision was used by Capt. Symes of the Cadillac after her collision with the Matoa in Hay lake channel. The bow was stove in on the starboard side down to the water line. The port compartments were filled and the steamer listed so that the hole was clear of the water line.

Four hundred and fourteen vessels were locked through the Canadian canal in September, having a registered tonnage of 312,924 tons, and carrying 182,030 tons of freight. The combined report of the two canals for the month shows an increase of 200,000 tons over the corresponding month last year. The east-bound freight amounted to 1,614,467 tons and west-bound to 519,211 tons.

The steamer Parks Foster ran into and sunk two small schooners Itasca and Mary in tow of the tug Haight in the southeast bend St. Clair river, Saturday night. The Haight seemed to misunderstand the signals and crossed the steamer's bow, clearing herself but bringing the schooner into collision. The Itasca was owned by C. E. Chilson, Lorain, and the Mary by Harriet Millard, Sarnia.

Three new vessels are classed in the October supplement of the Inland Lloyd's Register. The steamers Shenango No. 1 and Shenango No. 2 are each of 1,321 net tons register, and are given a valuation of \$150,000 each and A1st rating. The schooner Aurania, built by the Chicago Ship building Co. for John Corrigan of Cleveland, is rated A1 and valued at \$130,000. Her tonnage is 2,999 net.

Steamboat inspectors and United States marshals are looking for a man named Smith, who has been acting as chief engineer of the steamer Folsom. It is charged that in 1893 he stole from a tug in Buffalo an engineers license issued to Henry Beck. Working his fingers was easier than working his brains and he did the same thing the next year. This year Mr. Beck locked his license up and it is claimed that Smith presented the 1894 license in Cleveland and had it renewed under the name of Beck. If the charges can be proved and Mr. Smith can be caught he may wish he had got his license in the good old way.

The Cleveland centennial, to be held next year, certainly owes it to itself as an exposition of the growth of Cleveland to give considerable space and expense to illustrating its lake commerce, as but for this industry the city would have very little to celebrate. Secretary Elliott proposes to have a series of models on the tables 3 by 15 feet, representing the commerce by decades. Local ship building concerns will no doubt give assistance in this matter. The government exhibit will occupy a number of tables, and will include models of the great lock-canal system which connects the lakes, the light-houses, signals and other things incident to the government's departments on the lakes. The fisheries tables will show various kinds of nets used and how they are set together with the many interesting incidents of the trade which will lend themselves easily to portrayal in model.

Notice to Mariners.

Notice is hereby given that on September 6, 1895, a 10-inch steam whistle was established at Seul Choix Pointe light station, at the north-erly end of Lake Michigan, to sound, during thick or foggy weather, blasts of 4 seconds' duration, separated by silent intervals of 26 seconds, thus: Blast 4 seconds, silent interval 26 seconds. The fog-signal building is a red brick structure, with red iron roof, and stands 124 feet S. 51° E. (SE ½ E.) from the light-tower.

Capt. Wm. Hoag reports to the Hydrographic office the bearings of the shoal upon which the Colgate Hoyt grounded Oct. 1, at the entrance to the Soo river. He placed a temporary buoy there. The bearings are as follows: Frying pan island, S. by W. ½ W., Pipe island N. W., five-foot shoal W. S. W. Where the bearings intersect is the shoal, and the distance from Pipe island is ⅝ mile.

Notice is hereby given that on or about Oct. 17, 1895, the fixed red lantern light will be re-established on the outer end of the north pier at the entrance to the harbor of Kewaunee. The light will be shown at a height of 24 feet above main lake level from the outer end of an elevated conduit extending shoreward 200 feet to the tower from which Kewaunee pierhead light is shown, and with that light as a rear light, will form a range showing the direction of the piers and the course for entering the harbor.

Handsome Photographs of Lake Steamers.

For some time the REVIEW has been planning to secure photographs of lake vessels in motion, giving an artistic marine scene as well as a picture of the vessel. Arrangements have been completed and the first consignment has been received. They are 8 by 10 inches on tea colored mounts and will be sent to any address. We have a number in stock and as more are being taken every few days we can furnish almost any of the modern freight steamers at \$1 each. The following are on hand:

J. J. McWilliams,	J. N. Glidden,	Cherokee,	D. L. Leuty,
Yukon,	Wawatam,	Majestic,	F. L. Vance,
Colgate Hoyt,	Briton,	Chas. Hebbard,	Selwyn Eddy,
John Harper,	Pillsbury,	Saginaw Valley,	Forest City,
Gladstone,	Maritana,	S. S. Curry,	Wallula,
John V. Moran,	Malta,	H. J. Johnson,	Jim Sheriffs.
John Mitchell,	Quito,		

Send \$1 to the MARINE REVIEW, 516 Perry-Payne Bldg., Cleveland, O.

One fare rates to Buffalo Oct. 14 to 16 via the Nickel Plate road, account Union Veterans Legion of the United States. 425-10

Last of the season, Oct. 16, daylight excursion to Niagara Falls via the Nickel Plate road, \$3.00 for the round trip. Train leaves Pearl street 6:15 a. m., Broadway 6:20, Madison avenue 6:28, Euclid avenue 6:35. 440-15

Sault Canal Traffic.

Last month the bituminous coal shipments for the year were over 100,000 tons ahead of the season's shipments a year ago, but season's shipments to Oct. 1 show nearly 15,000 less, making a decrease in October shipments of about 145,000 tons and of anthracite there were about 10,000 tons less. Lack of cars may have something to do with the falling off but the advance in freights has helped shut down the shipments. Wheat shipments are 1,500,000 bushels less than on October 1 a year ago and this fact may play an important part in maintaining the 5-cent grain freight, for there is certainly more grain to come down than there was last year.

COAL SHIPMENTS TO LAKE SUPERIOR THROUGH SAULT CANAL.

	To Oct. 1, 1895.	To Oct. 1, 1894.
Bituminous, net tons.....	1,471,102	1,487,757
Anthracite, net tons.....	257,642	362,078
	1,728,744	1,849,835

General business of the canal for the month is again very heavy, and the season's commerce will, of course, exceed all previous records. Up to Oct. 1 the aggregate of freight passed through the canal was 10,990,826 net tons, of which 8,948,766 tons was east bound and 2,042,060 tons west bound.

ST. MARY'S FALLS CANAL TRAFFIC—OPENING OF NAVIGATION TO OCT. 1, SEASONS OF 1894 AND 1895.

EAST BOUND.

Freight items.	Designation.	To Oct. 1, 1894.	To Oct. 1, 1895.
Copper.....	Net tons.....	74,355	81,581
Corn.....	Bushels.....	1,425,571	69,859
Building stone.....	Net tons.....	17,970	20,917
Flour.....	Barrels.....	5,731,472	5,874,245
Iron ore.....	Net tons.....	5,247,323	6,574,495
Iron, pig.....	Net tons.....	15,891	17,978
Lumber.....	M. ft. B. M.....	540,369	607,108
Silver ore.....	Net tons.....	412	100
Wheat.....	Bushels.....	18,913,974	17,432,374
Unclassified freight.....	Net tons.....	100,193	110,331
Passengers.....	Number.....	12,731	14,473

WEST BOUND.

Coal, anthracite.....	Net tons.....	362,078	257,642
Coal, bituminous.....	Net tons.....	1,487,757	1,471,102
Flour.....	Bushels.....	783	2,150
Grain.....	Bushels.....	7,500	35,650
Manufactured iron.....	Net tons.....	21,043	55,547
Salt.....	Barrels.....	143,107	177,868
Unclassified freight.....	Net tons.....	177,138	204,613
Passengers.....	Number.....	12,747	15,149

Rescue of the C. A. King's Crew.

Considerable interest attaches to the loss of the schooner C. A. King and the rescue of her crew by the steamer E. C. Pope. The following account of it was furnished by Capt. Jno. H. Smith.

"On Sept. 26, 6 p. m. we were about 8 miles above Point Aux Barques on our course across the bay, water ballast in, wind west heavy, and heavy sea running. We made a schooner ahead with no lights out, under scant sail, squatted foresail and jib, and running close past her we heard the crew shouting 'We're sinking.' We immediately came about and found it was the C. A. King with starboard rigging gone, six feet of water in the hold, and making bad work of it. The captain wanted us to take a line and tow her to Sand Beach, but as that was impossible with a light boat, we assured him we would stay by him, which we did until 9:30 p. m. when by some accident the canvas came down and the schooner fell off in the trough of the sea. Then the seas commenced going over her. We came down close to her and heard cries of 'For God's sake come and take us off.' When we discovered that the crew had taken to the yawl boat, we then dropped down on the yawl to the windward with lines, ladders and life preservers ready, and took the crew out and cut the yawl adrift. Capt. Glen assured us that the schooner could not last half an hour, and we proceeded on our way and landed the crew, which consisted of captain, mate, woman cook and four sailors, at the Sault. The King was bound from Toledo to Bay City, soft coal laden. Capt. Glen lost everything in the world, and had no insurance."

Capt. H. Huntoon of the schooner E. R. Williams which foundered near Poverty island, Sept. 22, reports the very kind deeds of those connected with his rescue and care after they reached Manistique. He is very grateful to those who assisted him and especially the captain of the yacht Osceola who took them off the uninhabited island to Cheboygan, to Capt. J. H. Archer of the Minerva, and the masters and crews of the other two schooners who gave them provisions. The Odd Fellows, G. A. R., the Ladies' Aid Society, J. D. Niles, the tug men, the editors of the papers and citizens of Manistique were all very generous and the D. & C. line brought the captain and crew from Cheboygan to Detroit free of charge.

Diagram Showing the Distribution of the Steam on its Way Through a Triple Expansion Engine.

By W. F. Durand, Principal School of Marine Construction, Sibley College, Cornell University, Ithaca, N. Y.

Those who have attempted to follow, without the aid of special diagrams, the distribution of the steam as it passes through a triple expansion engine, have found that the problem soon attained a degree of complexity transcending all ordinary powers of mental vision. A diagram in order to efficiently aid should show:

- (1). The relative position of each crank at any part of the revolution.
- (2). The location of each piston for any given position of its crank, or of the high pressure crank taken as a standard of reference.
- (3). The volume above and below the piston for any position of the crank.
- (4). The clearance volume at each end of each cylinder.
- (5). The volume of each receiver.
- (6). The position of the crank and of the piston for each of the four valve events in each end of each cylinder.
- (7). The volumes which at any given position of the crank are in communication, and the complete history of the changes of volume, either by the motion of the piston or by the opening and closing of valve, throughout the entire revolution.

As an attempt to fulfil these conditions the following diagrams have been arranged:

When it is remembered that there are six cylinder volumes, six clearance volumes, two receiver volumes, and twenty four valve events to be noted, it is evident that such a diagram will naturally possess some complexity. This is a necessary result of an attempt to show to the eye an instantaneous view, so to speak, of a very complicated set of operations. We will now turn to the description of Fig. 1. We shall denote the cylinders by C_1 C_2 C_3 respectively, and the receivers by R_1 R_2 .

It will be noted that Fig. 1 relates to the more common arrangement of cranks with h. p. leading. Throughout the diagram horizontal distances measure degrees and therefore crank angles, while vertical distances measure volume to any arbitrary scale. Beginning at the top, the first rectangle relates to C_1 , the second to R_1 , the third to C_2 , the fourth to R_2 , and the fifth to C_3 . The constant vertical distance between the top line 0-360 and the dotted line $m m$ represents the clearance for the top end of C_1 . The similar distance between the lines $n n$ and $p p$ denotes the clearance for the bottom of the same cylinder, while that between $m m$ and $n n$ is the volume swept by the piston. The sinuous curve $m s m$ is then laid down so that the vertical distance of any point from $m m$ represents the volume swept above the piston for that location of the crank. If it were not for the effect due to the angularity of the connecting rod, this curve would be a sinusoid; but due to the influence of this angularity, it is well known that the sinusoid is slightly modified, the distances and volumes above the piston being somewhat increased, and those below somewhat decreased. If the diagram is to be used for actual measurement therefore, the exact curve as determined by geometrical construction or by analytical computation should be laid down. If it is intended simply for a graphical representation of operations, the sinusoid will answer every purpose.

We have thus between $m m$ and $m s m$ a graphical history of the variation throughout the revolution of the volume between the top of the piston and the end of the stroke, while between $m s m$ and 0-360 we have the history of the variation of the actual volume which is involved in all expansions and compressions.

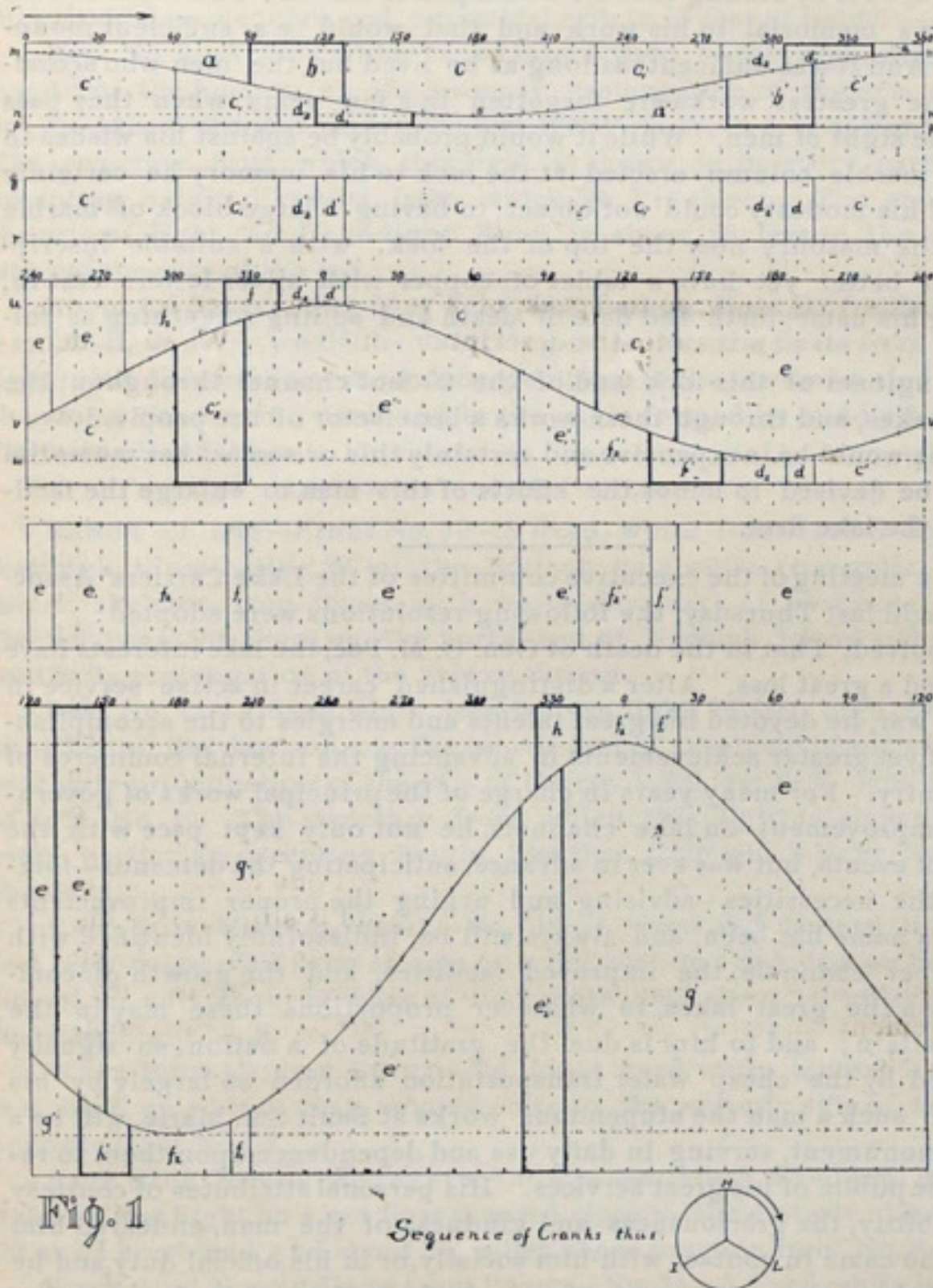
Similarly below $m s m$ we have the history of the simultaneous variation of the volume below the piston. The volume occupied by the piston rod is not here deducted. If measurements are to be made the necessary allowance is readily made. For mere representation this is unnecessary. The constant vertical dimension $q r$ of the next rectangle represents the volume of R_1 . The volume for C_2 and C_3 are represented in precisely the same manner as for C_1 ; and likewise for R_2 the same as for R_1 .

Each of the cylinder rectangles gives therefore a representation of the variation of the volume above and below the piston, both actual and swept according as it is reckoned to the dotted or full line, and they are so located that by following vertically downward from C_1 to C_2 and C_3 we have the simultaneous conditions at any one instant. Thus at the beginning where the angle is 0, the h. p. crank is at the top of the stroke, the i. p. crank is at 240° and is moving upward with its piston, and the l. p. crank is at 120° and with its piston is moving downward. The location of the i. p. piston in its stroke is readily seen by noting the position of v relative to u and w , and similarly for the l. p. piston. These relative positions and directions of motion are seen to agree with the sequence of cranks as shown. The simultaneous conditions for any other instant are readily seen in precisely the same way.

We have thus far shown that at any instant or any position of the h. p. crank or piston, the corresponding positions of the other pistons and cranks may be seen, and the volumes above and below each piston

determined. We now turn to the valve events. These are noted for each end of each cylinder by a heavy vertical line. Thus for C_1 at the top, cut off is at 90° , exhaust opens at 129° , exhaust closes at 305° and steam opens at 340° . The angular periods during which the valve is shut allowing steam neither to flow into nor out of the cylinder, are denoted by heavy horizontal lines. The remaining periods during which it is open, thus allowing either entrance or exit, are denoted by light horizontal lines. Light vertical lines denote changes in connections due to valve events in some other member of the engine. These are determined by projecting any heavy line throughout all members involved in the change which it denotes. Thus exhaust in the top of C_1 occurs at 129° . This admits steam into R_1 and into the top of C_2 whose steam valve opened, as shown, at 341° , or 19° before the end of the stroke. The heavy line denoting exhaust in C_1 is therefore projected down through R_1 and the top of C_2 as shown in light lines. Similar instances occur throughout the diagram.

While the three volumes thus concerned are shown separately on the diagram, they are supposed to be continuously connected together and with free passage for steam throughout, thus making in effect but one volume whose amount is represented by the sum of the parts shown in



the diagram. The variation of the entire volume is therefore shown by the variation in length, of a line representing the sum of the partial volumes at successive angular positions.

Each closed area on this diagram represents therefore either the whole or a part of a certain operation constituting an element of the complete cycle of changes. In order more readily to associate the different areas belonging to the same operation, they have each the same letter, and there are therefore as many letters as there are operations in the revolution. This is found to be thirty-two. All areas therefore with the same letter belong to the same operation, and the corresponding volumes are continuously connected. With this explanation of the method of representation, we will follow through a part of Fig. 1; a is the period of steam admission in C_1 . Cut off is at 90° and b is the period of expansion. Exhaust opens at 129° connecting the top of C_1 with R_1 and the top of C_2 , and thus adding their volumes and the contained steam. The result is the period c , or exhaust and expansion into R_1 and the top of C_2 . The cut off in the latter is at 110° thus terminating the period c . The quantity present in these three members is then divided into two parts, one in C_2 and the other in C_1 and R_1 . Following the latter we have the period c_1 of exhaust and compression into R_1 . This lasts until steam opens on the bottom of C_2 at 160° thus connecting the corresponding volumes and adding the quantities of steam. We then have the period d_2 during which steam passes from the top of C_1 through R_1 into the bottom of C_2 . This lasts until exhaust closes in C_1 at 305° . Then follows com-

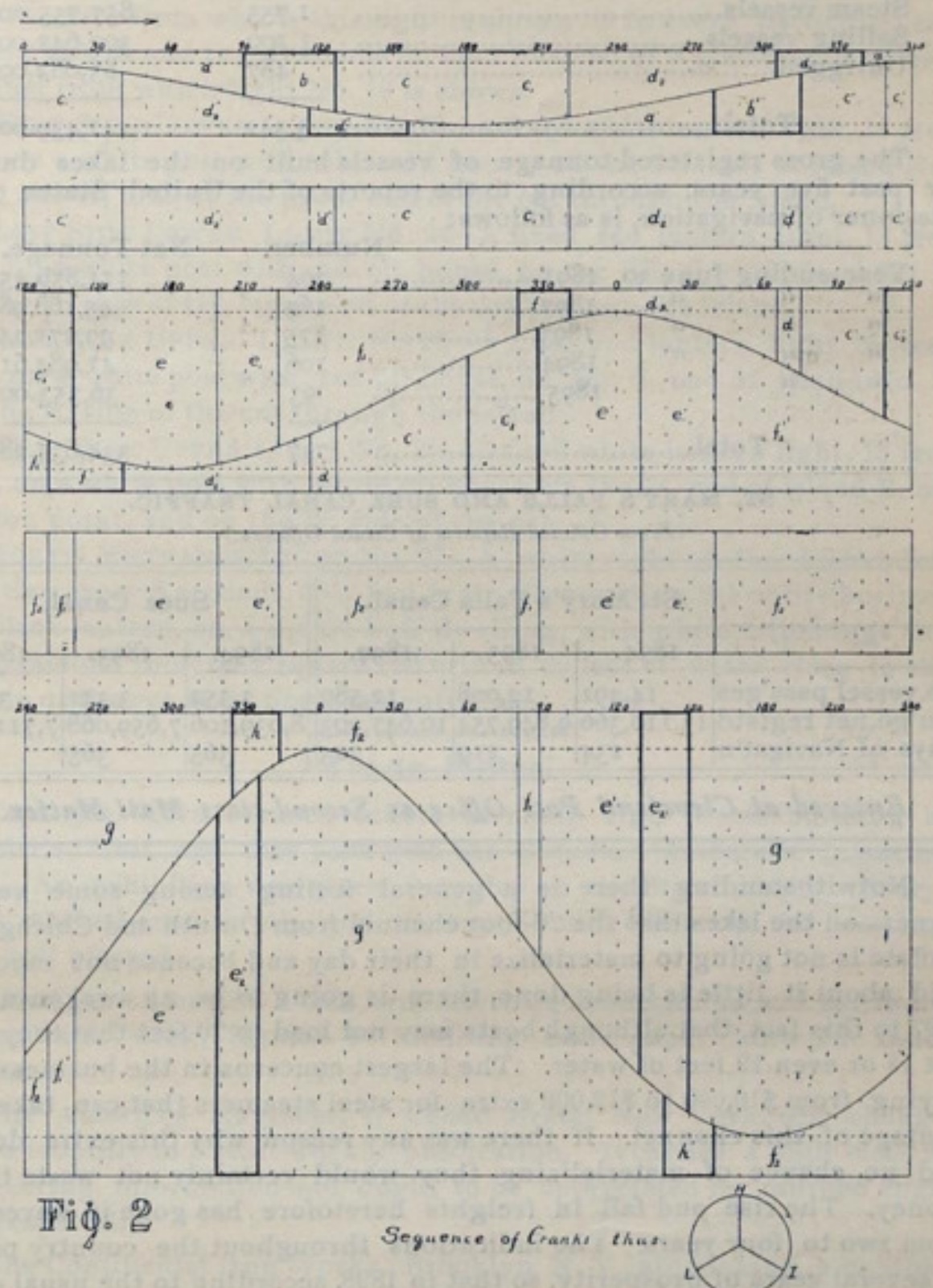
pression during the period d_1 , followed by steam entrance for a new revolution as before. In the same way we may follow on from c_2 and similarly throughout the diagram.

It is thus seen that the steam in passing, say from the top of C_1 goes sometimes into R_1 and the top of C_2 , sometimes into R_1 , and the bottom of C_2 , and sometimes into R_1 alone. Likewise the location and movement of the crank and piston for these and all other periods as well as the corresponding changes in volume, are all shown by following through the diagram in the same manner as above.

Many other interesting relations may be obtained by a study of the diagram, but enough has been pointed out to show its application to the representation of the distribution and volumetric history of the steam throughout the revolution.

The actual duration and location of the various periods will depend, of course, on the various valve events, but so long as the sequence of cranks is that for which figure 1 is arranged, the general character of the distribution will not essentially vary from what is there shown.

Fig. 2 gives the corresponding distribution for the other sequence of cranks. A comparison of the two diagrams will be of much interest, as



they show clearly the various details of the difference in the distribution of the steam in the two cases.

Corsica-Fryer Collision.

Capt. Cummings of the steel steamer Corsica is thus quoted regarding the collision which resulted in considerable injury to his vessel and the sinking of the steamer Fryer near the dyke in Hay lake channel on Sept. 27: "We left the Sault at 5:30 a. m. with the Sauber ahead of us and large fleet behind us. Everything went well until below the dyke at the lower end of Hay lake we saw the Fryer ahead and she blew one whistle to take the port side. We answered her with one whistle. We were going under a slow check at the time. Just before we got to her, she took a sheer and went straight across the channel, too late then to cross sides. We both stopped and backed, but too late to avoid coming together. We struck her on the starboard bow and she sank immediately." The hole in the Corsica extends from within 2 feet of the keel up to the main deck and is 10 feet long. Rivets extending through plates and frames will be blown out with dynamite and a timber patch bolted on through the rivet holes, just as was done in the case of the Alva. About ten days will probably be required to make these temporary repairs, before the steamer can proceed on her way to Cleveland to be docked.



DEVOTED TO THE LAKE MARINE AND KINDRED INTERESTS.

Published every Thursday at No. 516 Perry-Payne building, Cleveland, O

SUBSCRIPTION—\$2.00 per year in advance. Single copies 10 cents each. Convenient binders sent, post paid, 75 cents. Advertising rates on application.

The books of the United States treasury department on June 30, 1895, contained the names of 3,342 vessels, of 1,241,459.14 gross tons register in the lake trade. The number of steam vessels of 1,000 gross tons, and over that amount, on the lakes on June 30, 1894, was 359 and their aggregate gross tonnage 634,467.84; the number of vessels of this class owned in all other parts of the country on the same date was 316 and their tonnage 642,642.50, so that half of the best steamships in all the United States are owned on the lakes. The classification of the entire lake fleet on June 30, 1895, was as follows:

Class.	Number.	Gross Tonnage.
Steam vessels.....	1,755	857,735.00
Sailing vessels.....	1,100	300,642.00
Unrigged.....	487	83,082.00
Total.....	3,342	1,241,459.00

The gross registered tonnage of vessels built on the lakes during the past five years, according to the reports of the United States commissioner of navigation, is as follows:

Year ending June 30,	Number.	Net Tonnage.
1891.....	204	111,856.45
" " " 1892.....	169	45,168.98
" " " 1893.....	175	99,271.24
" " " 1894.....	106	41,984.61
" " " 1895.....	93	36,353.00
Total.....	747	334,634.28

ST. MARY'S FALLS AND SUEZ CANAL TRAFFIC.

(From Official Reports of Canal Officers.)

	St. Mary's Falls Canal.			Suez Canal.		
	1894.	1893.	1892.	1894.	1893.	1892.
No. vessel pass'ges	14,491	12,008	12,580	3,352	3,341	3,559
T'n'ge, net registd	13,110,366	9,849,754	10,647,203	8,039,106	7,659,068	7,712,028
Days of Navigat'n	234	219	223	365	365	365

Entered at Cleveland Post Office as Second-class Mail Matter.

Notwithstanding there is a general feeling among some vessel owners on the lakes that the 20-foot channel from Duluth and Chicago to Buffalo is not going to materialize in their day and because not much is said about it little is being done, there is going to be an awakening in 1897 to this fact, that although boats may not load to 20 feet that they can get 18 or even 19 feet of water. The largest concerns in the business are paying from \$10,000 to \$12,000 extra for steel steamers that can take advantage of this channel. If there was any reason why this extra depth had no chance of materializing they would certainly not waste their money. The rise and fall in freights heretofore has gone in waves of from two to four years. The indications throughout the country point to several years of prosperity, so that in 1898, according to the usual conditions a decline may be expected. The 20-foot channel, giving 20 feet, or a depth three or four feet greater than that available at present will be completed by that time. Suppose the rates fall to the condition they were in this season. Even at their worst the modern steel freighters made a fair profit. But the large portion of the lake fleet barely made expenses or in many cases lost money. The fact that ship building will go on at the present rate as long as profitable freights can be secured must be considered. And at least three-fourths of the ships built will be the modern steel freighter which will be available for the greatest depth afforded. Therefore in 1898 a large fleet will be ready to take advantage of this increased draft. Then the carrying capacity of this fleet will be increased from 20 to 30 per cent. And although production increases as it has in the past ten years, the ship yard production has always led in the matter of furnishing plenty of vessels to carry the products. It would seem then that the season of 1898 will open with two conditions, an excess of carrying tonnage and a decrease in freights. The concerns who own and manage the steamers available for increased depth have very little interest in the smaller wooden vessels and being so greatly in the majority they will determine what the freights shall be. It is reasonable to suppose they will bid low enough to get sufficient ore, coal and grain to keep them busy. And they can bid so low that the business will be practically prohibitory for the smaller class of tonnage. Still they can make as much as the smaller vessels have been making in prosperous times. Ten or twenty years ago the canal schooners did a flourishing business in carrying grain from Chicago to Lake Ontario. They drew on

an average of ten feet but could be loaded to eleven feet. Canal and channel improvement gave fourteen feet draft and this class of vessels were displaced by steamers that paid for themselves in three or four seasons and made more money at lower rates than the "canalers" did in their palmiest days. Four feet was added to the available depth and the lake carrying trade was revolutionized, and outside capital was introduced. Within the next four years it is not unreasonable to expect four feet more. Is it unreasonable to expect that the change in the class of freight carriers will be less radical. Of course a great volume of business unknown to the trade at present may be brought forth by development and there may be sufficient commodities to furnish profitable business for the present fleet of smaller vessels in other trades. But this deeper channel is coming, unless these waters are to be tapped by Chicago drainage canals and other outlets, and it is going to be a factor in the lake trade worthy of serious consideration. It is better to look the problem in the face than, because it seems to be difficult, to try to believe it is not there.

IT WOULD seem very fitting that the Lake Carriers' Association reconsider the matter of a memorial to Col. O. M. Poe. This was considered not long since but as soon as it was known to the modest engineer he discouraged it by stating that he would prefer that the new 400-foot lock stand as a memorial to his work and that would be a sufficient monument. And it was sufficient as long as he lived but the men who accomplish the greatest works are forgotten in a few years when they pass from the sight of men. While it would probably be against his wishes to have a marble column erected at the lock to his memory he certainly with all his modesty could not object to having a large block of marble set in the masonry near the top of the lock, with a suitable inscription, or better yet have a tablet of copper with silver letters cast in, bearing his name, birth and date of death and adding something as follows:

"Engineer of this lock and of the 20-foot channel throughout the Great Lakes, and through these works a benefactor of the people."

This would be inexpensive and certainly this or some other memorial should be devised to honor the efforts of this man to enlarge the facilities of the lake fleet.

At a meeting of the executive committee of the Lake Carriers' Association held last Thursday, the following resolutions were adopted:

Resolved, That in the death of Gen. O. M. Poe, the lake interests have sustained a great loss. After a distinguished career in active service in time of war, he devoted his great talents and energies to the accomplishment of yet greater achievements in advancing the internal commerce of his country. For many years in charge of the principal works of government improvement on lake channels, he not only kept pace with the march of events, but was ever in advance, anticipating the demands—foreseeing the necessities—advising and urging the proper improvements until his name has been, and always will be, indissolubly identified with the deeper channels, the improved facilities, and the growth of commerce on the great lakes, to whatever proportions these may in the future attain; and to him is due the gratitude of a nation, so signally benefited by the cheap water transportation afforded so largely by his aid. To such a man the stupendous works at Sault Ste. Marie, will be a fitting monument, serving in daily use and dependence upon them to remind the public of his great services. His personal attributes of courtesy and affability, the graciousness and kindness of the man, endeared him to all who came in contact with him socially, or in his official duty, and he leaves behind the sweet savor of a good life, well-spent in the able discharge of important duties.

Resolved, That we express our deep sense of personal loss in the death of General Poe, and to his immediate family we extend our sympathy.

Resolved, That these resolutions be spread upon the records of the Lake Carriers' Association, and, that a copy be sent, by the secretary, to the family of the deceased.

Lake Ship Building Greater than Coast Building.

A glance at the table below showing the ship building of the United States during the past three months to Sept. 30, shows that about one-third of the wooden ships built were from lake yards and over half of the iron and steel ships shown were built on the lakes. Of steam vessels all kinds the lakes furnished over two-thirds.

	WOOD.				IRON.				STEEL.			
	Sail.		Steam.		Sail.		Steam.		Sail.		Steam.	
	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.	No.	Gross.
Atlantic & Gulf.	88	12321.38	27	2263.26	.....	.....	2	326.29	.....	.....	4	12174.61
Pacific.....	12	2468.45	5	461.13	.....	.....	.....	.....	.....	.....	.....	.....
Great lakes.....	5	125.00	23	5829.53	.....	.....	.....	.....	2	5230.98	6	14816.92
Western rivers..	1	20.97	25	3116.37	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	106	14935.80	80	11570.29	.....	.....	2	326.29	2	5230.98	10	26991.53

Hay Lake Channel Lights.

The light-house board has at last issued a description of new lights for the navigation of Hay lake channel by night. Oct. 5 was the date fixed for the establishment of the lights. Following is the notice, in which distances are in statute miles:

MIDDLE NEEBISH CUT LIGHTS.

NORTH SIDE—Lower No. 2, Middle No. 4, Upper No. 6—Each a fixed red lantern light, 20 feet high, suspended above the northerly edge of the cut from the outer end of the boom of a red derrick-like structure erected, respectively, on the lower end, middle and upper end of the stone dike running parallel with the cut. Light No. 4 is about 2,600 feet and light No. 6 about 5,500 feet NNW. $\frac{1}{8}$ W. from No. 2.

SOUTH SIDE—Lower No. 1, Middle No. 3, Upper No. 5—Each a fixed white lantern light, 12 feet high, suspended from an arm on a white post standing in the center of a black raft-like float moored close to the southerly edge of the cut, respectively, opposite lights Nos. 2, 4 and 6.

RANGE LIGHTS—Front No. 7—A fixed white lens-lantern light, 23 feet high, illuminating 90° of the horizon, on the westerly prolongation of the axis of the cut, suspended centrally in front of a white day mark of vertical slats on the outer end of the boom of a brown derrick-like structure erected on a square, red, pyramidal crib in 18 feet of water.

Rear No. 9—A fixed white lens-lantern light, 34 feet high, illuminating 90° of the horizon, on the westerly prolongation of the axis of the cut, in 14 feet of water, and 2,500 feet WNW. $\frac{1}{8}$ W. in rear of light No. 7. The structure from which this light is shown is, in every particular, excepting height, like that from which No. 7 is shown. The center of the crib of light No. 7 and light No. 9 is about 25 feet to the southward of the axis of the cut.

JUNCTION LIGHT—No. 8—A fixed red lantern light, 12 feet high, on a red float, in every particular excepting color like the floats from which lights Nos. 1, 3 and 5 are shown, moored close to the northeast side of the channel at the turning point and in the angle formed by Middle Neebish and lower Hay lake cuts.

LOWER HAY LAKE CUT LIGHTS.

RANGE LIGHTS—Front No. 10—A fixed white lens-lantern light, 52 feet high, illuminating 90° of the horizon, on a white, triangular, pyramidal, skeleton, iron tower, with white day mark of horizontal slats, erected near the shore on the north end of Neebish island and on the southerly prolongation of the axis of the cut.

Rear No. 11—A fixed white lens-lantern light, 70 feet high, illuminating 90° of the horizon, on the north end of Neebish island and the southerly prolongation of the axis of the cut, 2,500 feet SSE. $\frac{5}{8}$ E. in rear of light No. 10. The structure from which this light is shown is, in every particular, excepting height, like that from which light No. 10 is shown.

EAST SIDE MIDDLE LIGHT—No. 12—A fixed red lantern light, 12 feet high, suspended from an arm on a red post on a red crib on the east side of the cut, about midway of its length, and about $1\frac{1}{8}$ miles above Junction Light No. 8.

WEST SIDE MIDDLE LIGHT—No. 13—A fixed white lantern light, 12 feet high, on a black float moored close to the westerly side of the cut, opposite light No. 12.

EAST SIDE NORTH ENTRANCE LIGHT—No. 14—A fixed red lantern light, 12 feet high, on a red float moored close to the easterly side of the cut at its north end, and about $2\frac{3}{4}$ miles above junction light No. 8.

WEST SIDE NORTH ENTRANCE LIGHT—No. 15—A fixed white lantern light, 12 feet high, on a black float moored close to the westerly side of the cut at its north end, and opposite light No. 14. The floats from which lights Nos. 13, 14 and 15 are shown, are in every particular, excepting color in the case of light No. 14, like those from which lights Nos. 1, 3 and 5 are shown.

NINE-MILE POINT LIGHT—No. 16—A fixed red lens-lantern light, 20 feet high, illuminating 270° of the horizon, and visible to vessels from all points of approach, on a white post attached to a small red house on a square red pyramidal crib in 12 feet of water off Nine-Mile point, and just to the eastward of the turning point from the lower Hay lake cut range line to the middle Hay lake range line.

MIDDLE HAY LAKE CHANNEL LIGHTS.

RANGE LIGHTS—Front No. 17—A fixed white lens-lantern light, 30 feet high, illuminating 90° of the horizon, on a white post with white day mark, on a square red pyramidal crib in 20 feet of water, about $\frac{1}{2}$ mile N by E. $\frac{1}{2}$ E. of Six-mile point, and to the eastward of the southerly end of the upper Hay lake cut.

Rear No. 18—A fixed white lens-lantern light, 80 feet high, illuminating 90° of the horizon, on a white, triangular, pyramidal, skeleton, iron tower, with white day mark of horizontal slats, on a square red crib in 8 $\frac{1}{2}$ feet of water, 4,000 feet N. by W. $\frac{1}{8}$ W. in rear of light No. 17.

UPPER HAY LAKE CUT LIGHTS.

FRECHETTE POINT RANGE LIGHTS—Front No. 21—A fixed white lens-lantern light, 54 feet high, illuminating 180° of the horizon, on a

white, triangular, pyramidal, skeleton, iron tower, with white day mark of horizontal slats, on a platform on piles in 3 feet of water, about $\frac{3}{8}$ miles below Frechette point and on the northerly prolongation of the axis of the upper Hay lake cut.

Rear No. 22—A fixed white lens-lantern light, 80 feet high, illuminating 180° of the horizon, in 4 feet of water, nearly $\frac{3}{8}$ mile above Frechette point, on the northerly prolongation of the axis of the cut, and 2,800 feet NW. $\frac{3}{4}$ N. in rear of light No. 21. The structure from which this light is shown is in every particular, excepting height, like that from which light No. 21 is shown.

LITTLE RAPIDS CUT LIGHTS.

SIX-MILE POINT RANGE LIGHTS—Front No. 19—A fixed white lens-lantern light, 54 feet high, illuminating 90° of the horizon, on a white, triangular, pyramidal, skeleton, iron tower, with white day mark of horizontal slats, on a platform on piles in 3 feet of water, about $1\frac{1}{8}$ miles above Six-mile point, and on the southerly prolongation of the axis of the Little Rapids cut.

Rear No. 20—A fixed white lens-lantern light, 82 feet high, illuminating 90° of the horizon, on Six-mile point and the southerly prolongation of the axis of the cut, 6,000 feet SSE. $\frac{5}{8}$ E. in rear of light No. 19. The structure from which this light is shown is in every particular, excepting height and that it stands on land (instead of a platform on piles), like that from which light No. 19 is shown.

WEST SIDE LOWER LIGHT NO. 23—A fixed white lantern light, 18 feet high, on a white post with white oil house, on the SE. side of island No. 1, and the W. side of the lower end of the cut through the island.

EAST SIDE LOWER LIGHT NO. 24—A fixed red lantern light, 18 feet high, on a white post with red oil house, on the SE. side of island No. 1, and the E. side of the lower end of the cut through the island.

EAST SIDE UPPER LIGHT NO. 26—A fixed red lantern light, 18 feet high, on a white post with red oil house, on the N. end of island No. 1, and the E. side of the cut through the island.

WEST SIDE UPPER LIGHT NO. 25—A fixed white lantern light, 18 feet high, on a white post with white oil house, on the N. end of island B, off Mission point, and on the W. side of the cut.

NORTH ENTRANCE LIGHT NO. 27—A white light of the fifth order, occulting every 5 seconds, 36 $\frac{3}{4}$ feet high, illuminating the entire horizon, in a black lantern, on a square buff dwelling, with white trimmings and red pyramidal roof, on a square red crib in 20 feet of water, close to the W. side of the cut at its northern entrance.

Trade Notes.

Capt. Jas. Lord secured orders to equip eight boats building at Wheeler's West Bay City yard with the Standard automatic releasing hook. An exhibition was given Saturday on the State of Ohio. Everything worked successfully and the captain and officers of the company were well pleased.

The Age of Steel, St. Louis, will alternate a mechanical and hardware edition each week, instead of dividing each paper between those subjects.

The American Engineer, 47 Cedar street, New York, will change from a monthly to a semi-weekly publication. It carries a high class of engineering information and ought to be appreciated by railroad engineers especially.

The Continental Iron Works, Brooklyn, N. Y., are making a number of Fox corrugated furnaces for William B. Pollock & Co., Youngstown, Ohio; Jos. T. Ryerson & Son, Chicago, Ill.; Heipershausen Bros., New York; William Cramp & Sons, Neafie & Levy and Harlan & Hollingsworth.

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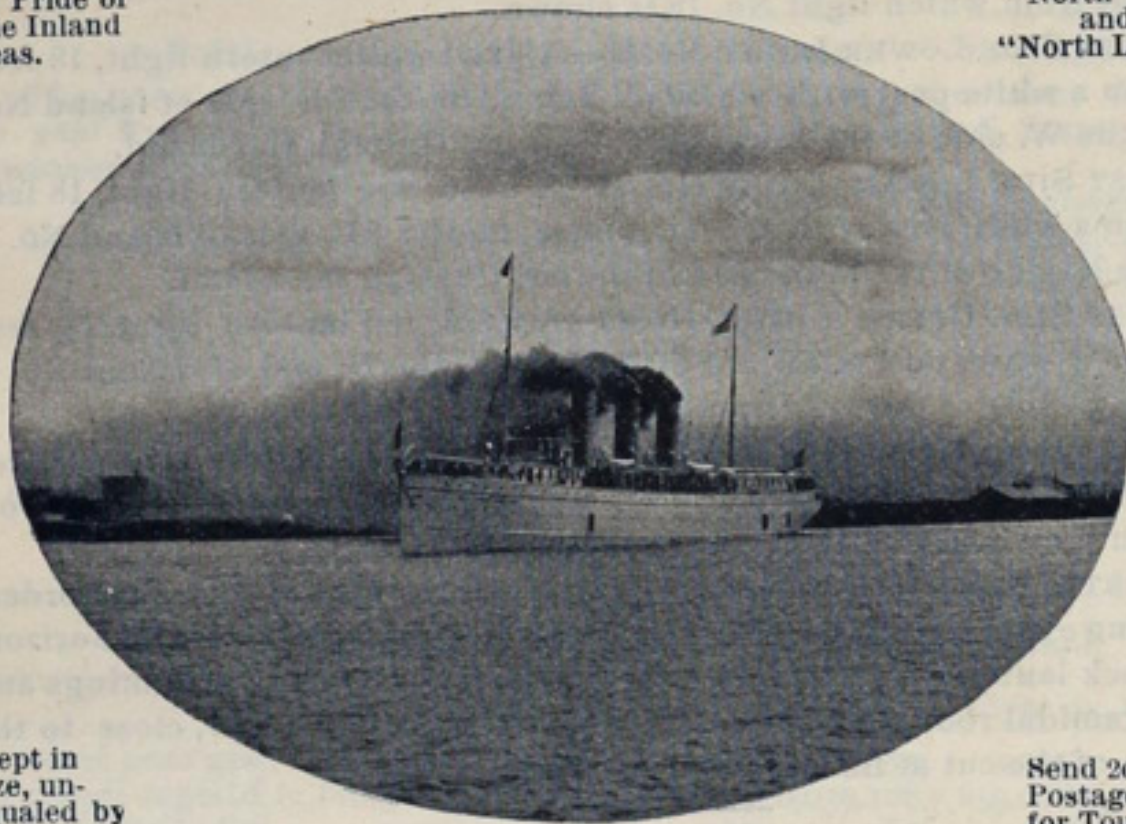
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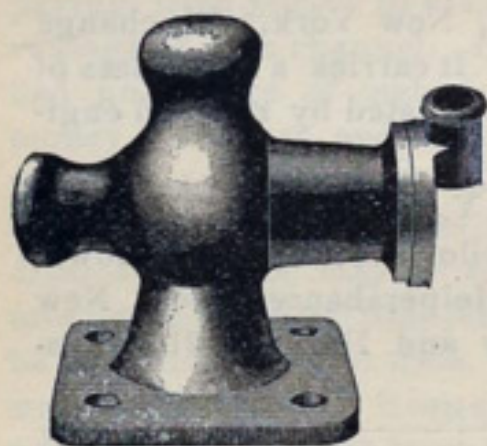
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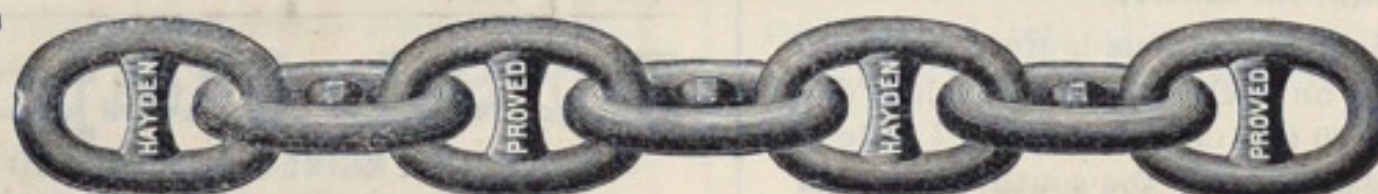
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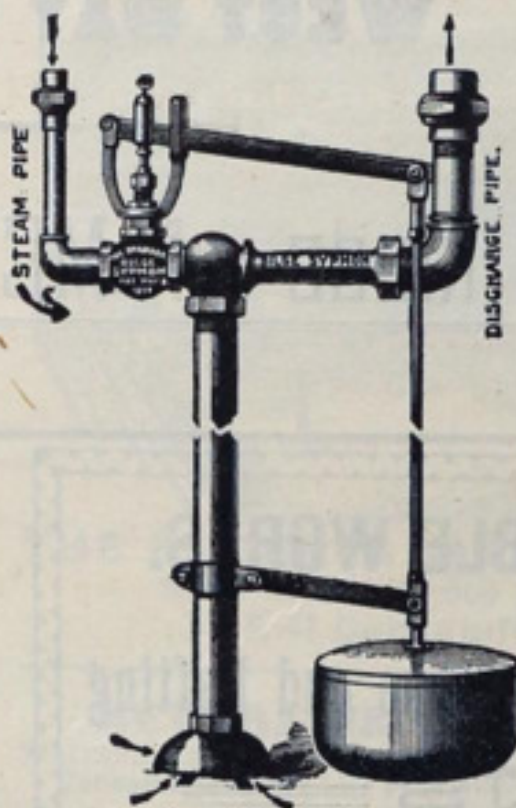
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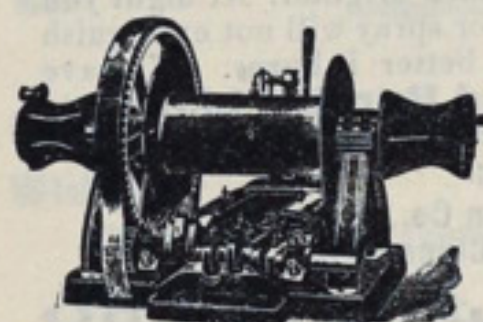
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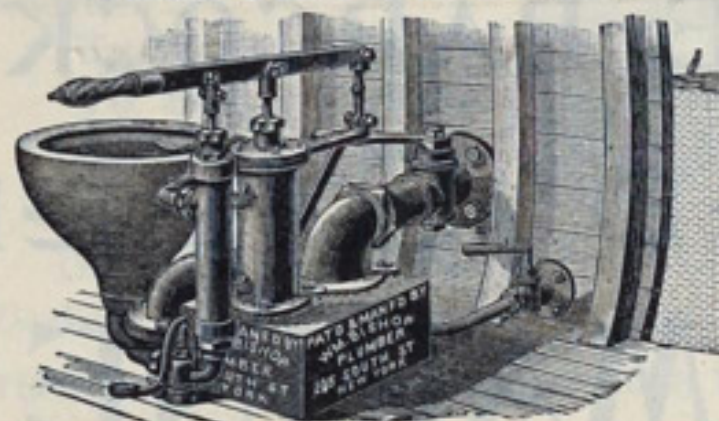
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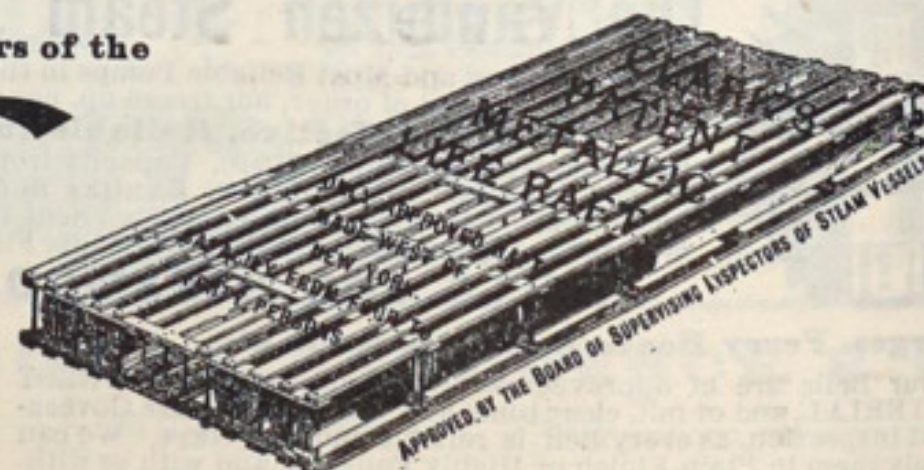
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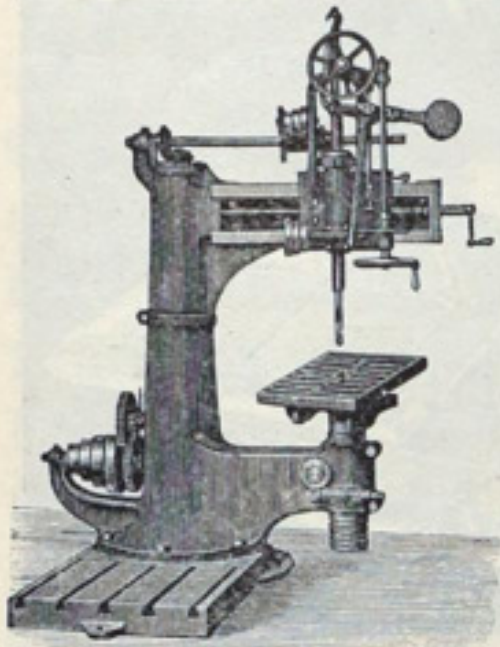
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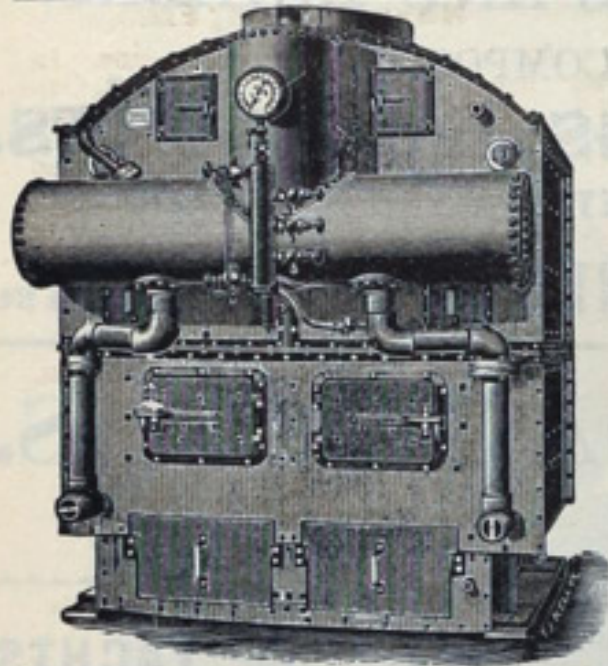
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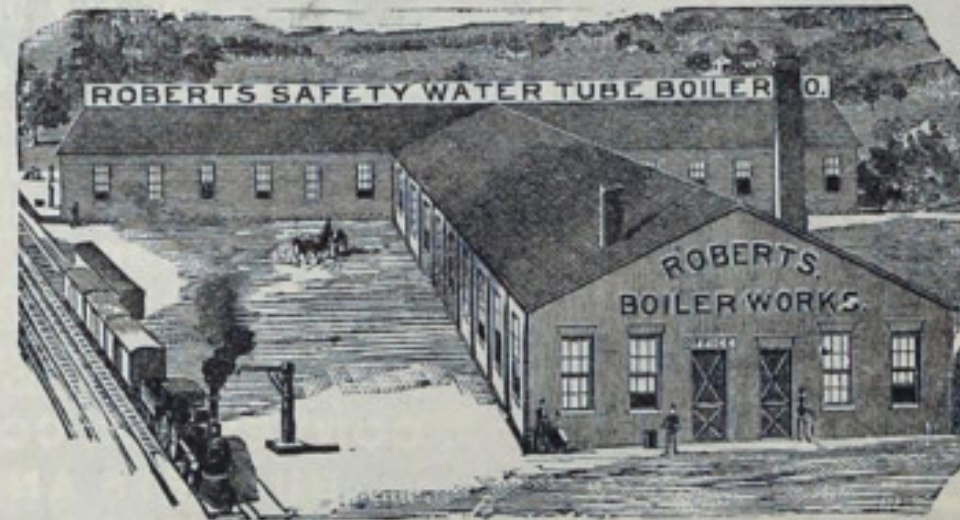
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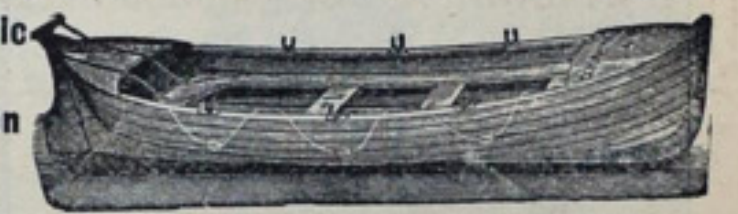
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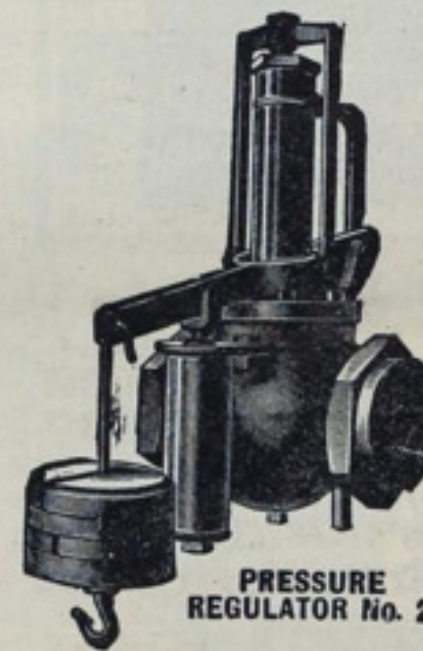
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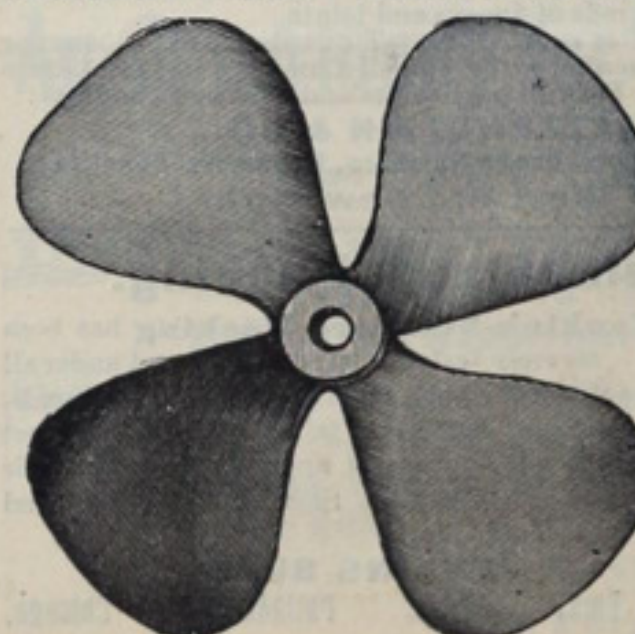
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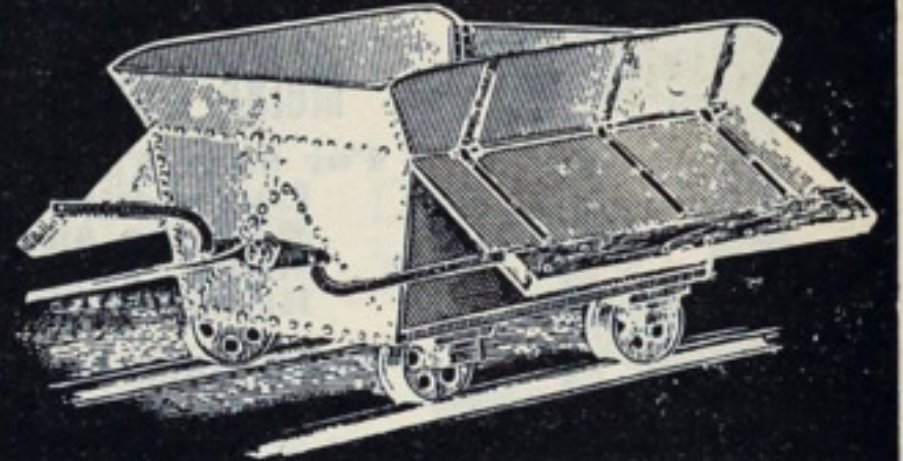
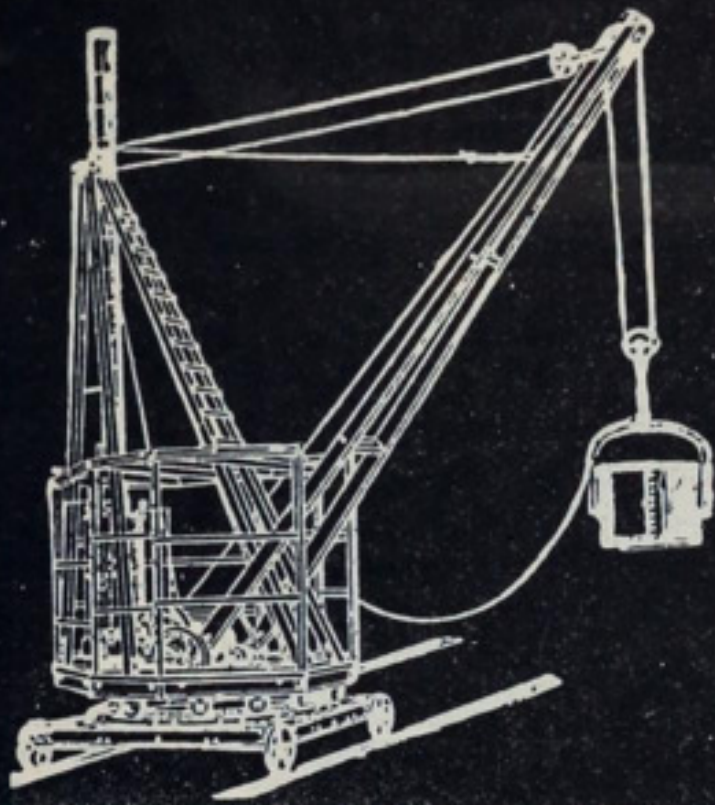
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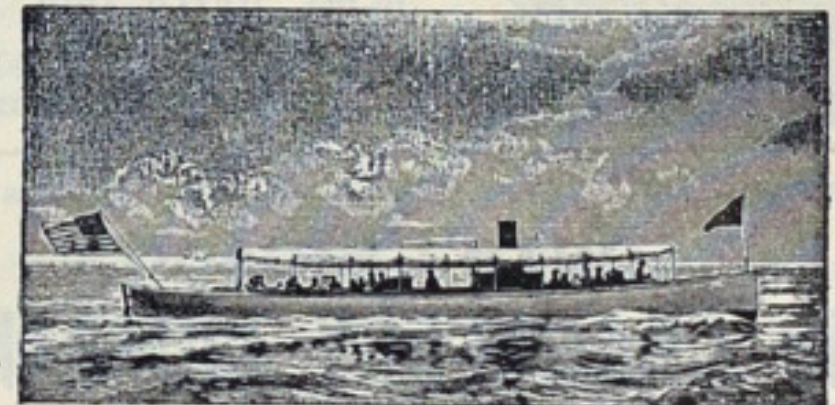
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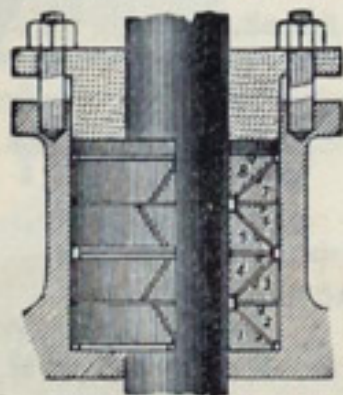
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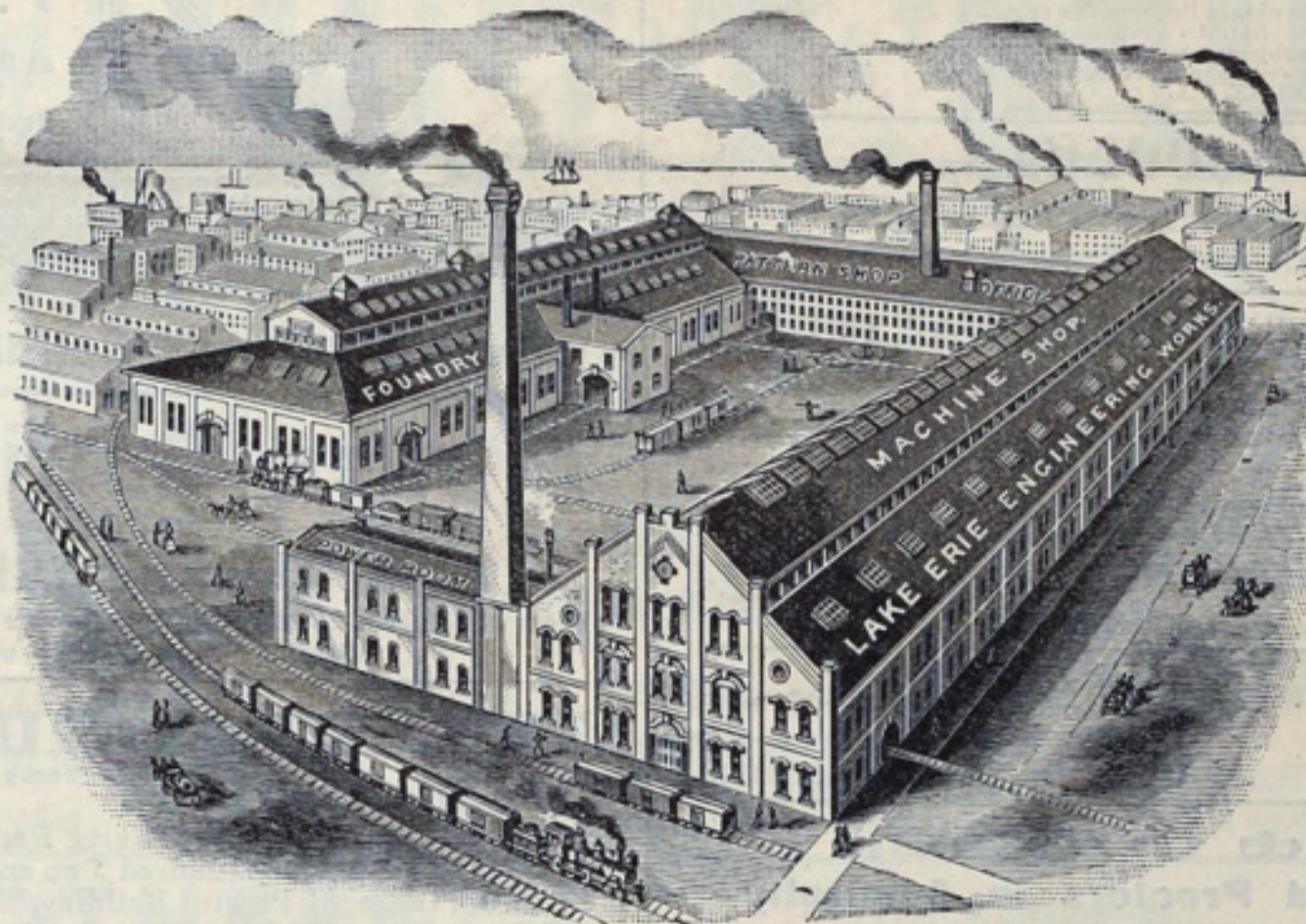
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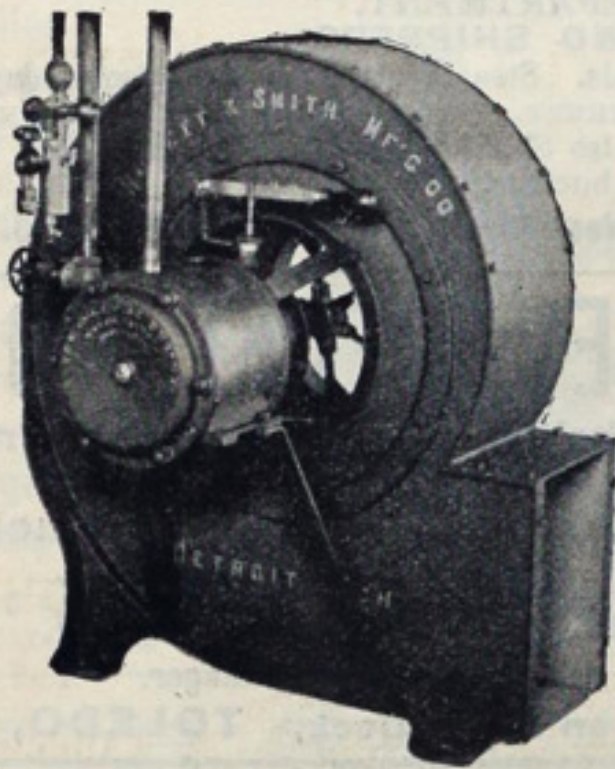
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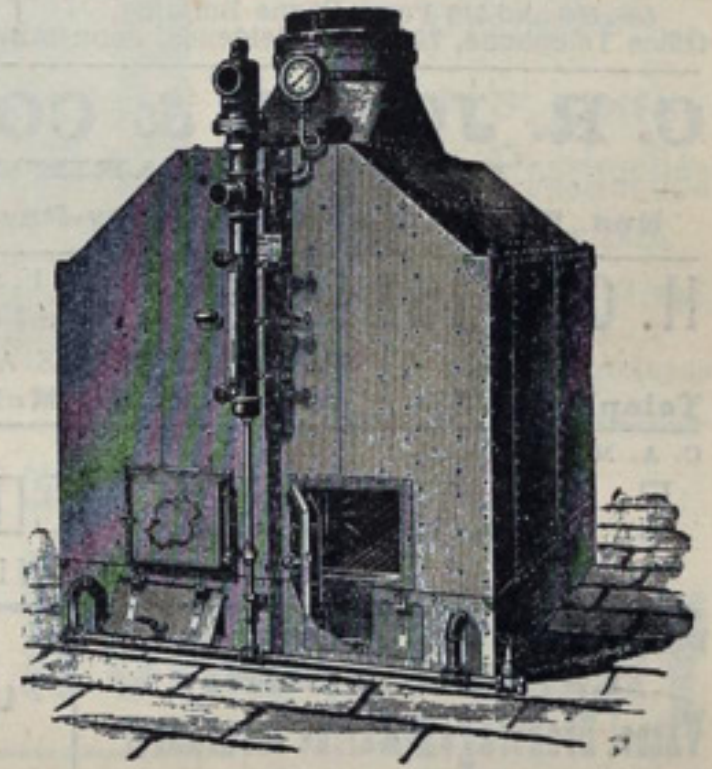
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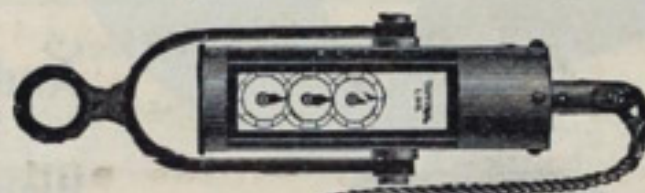
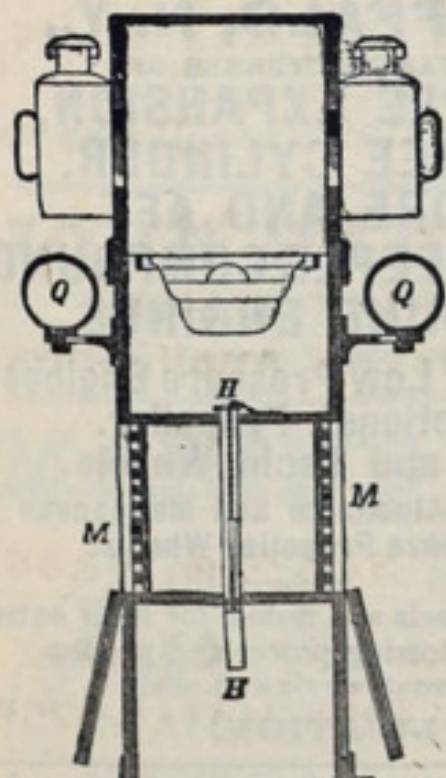
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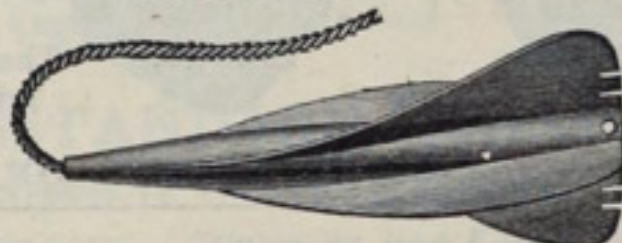
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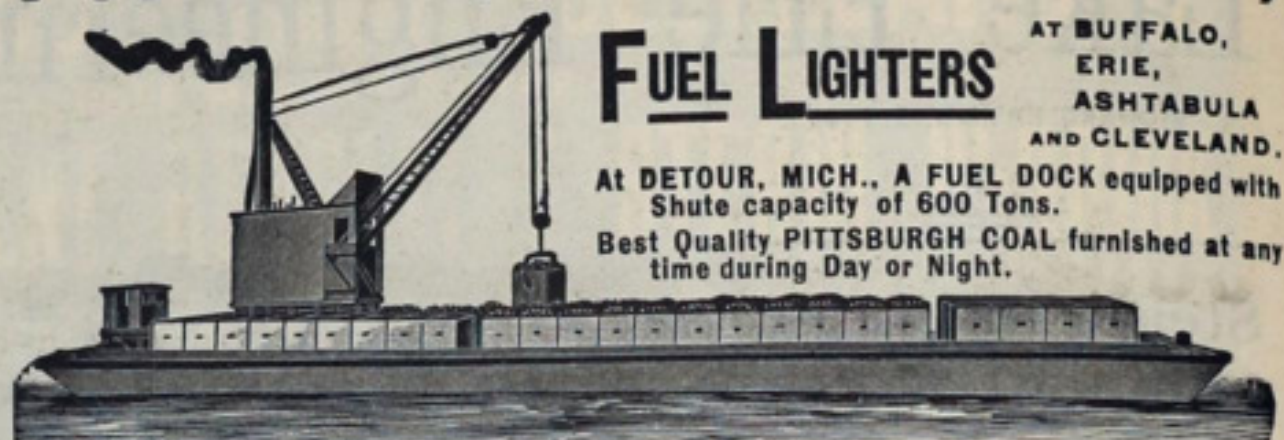
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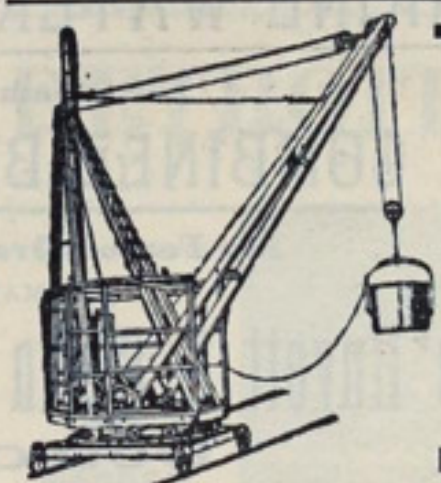
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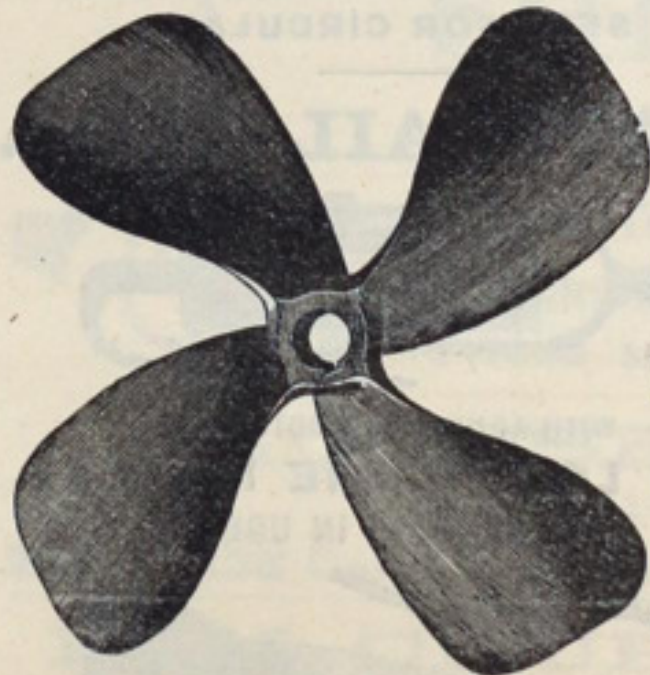


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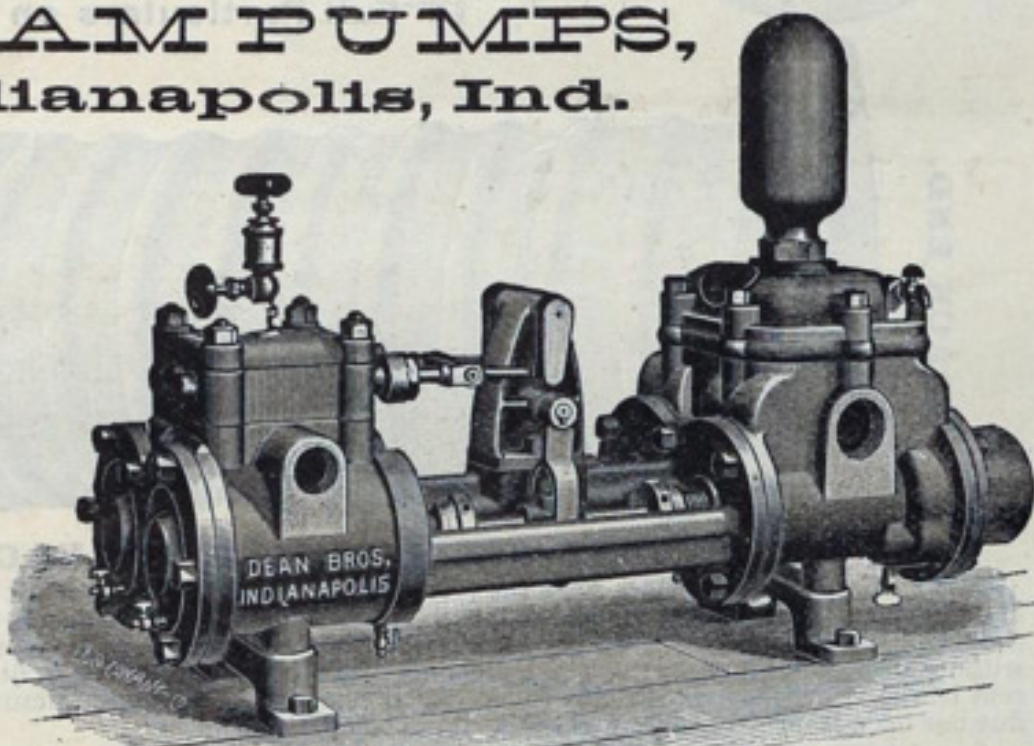
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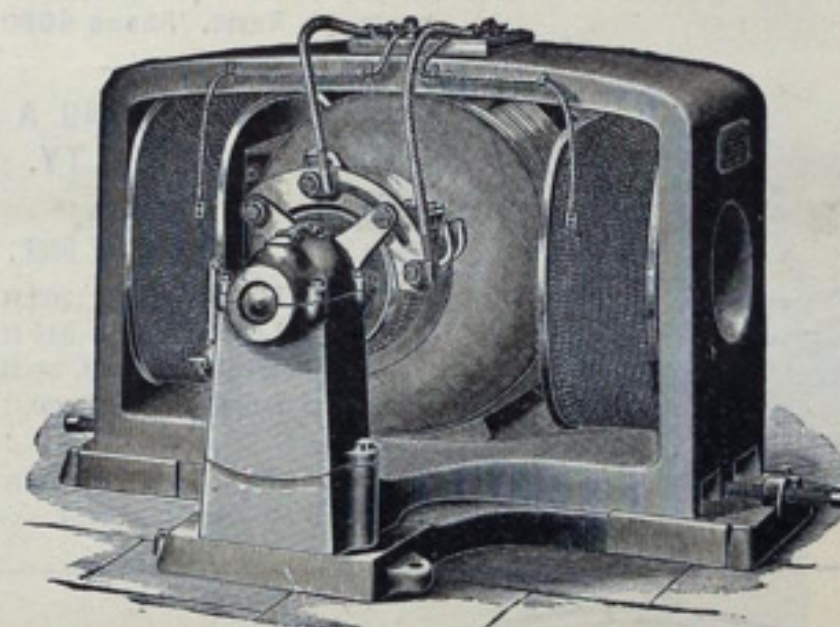
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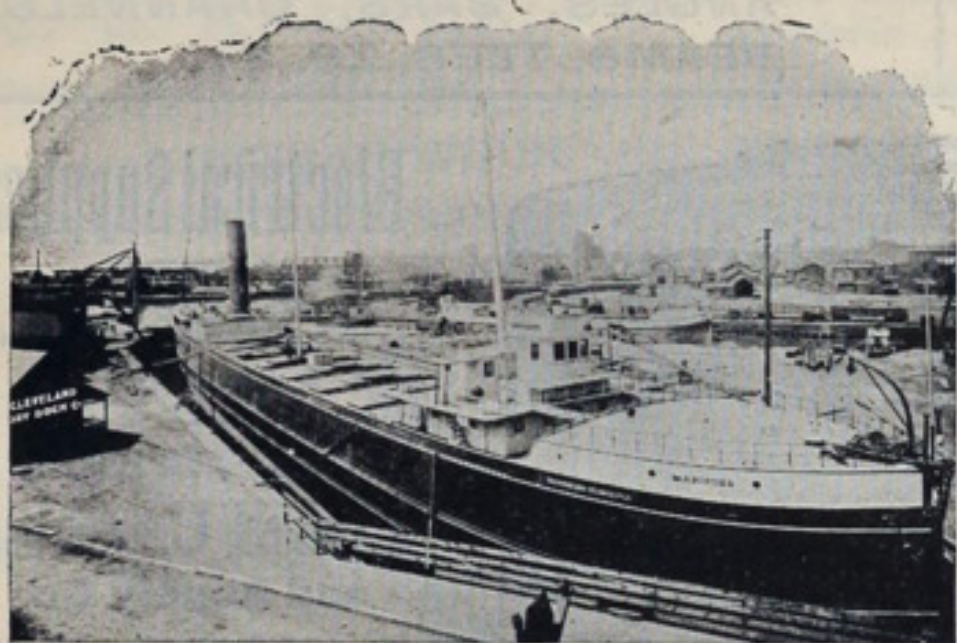
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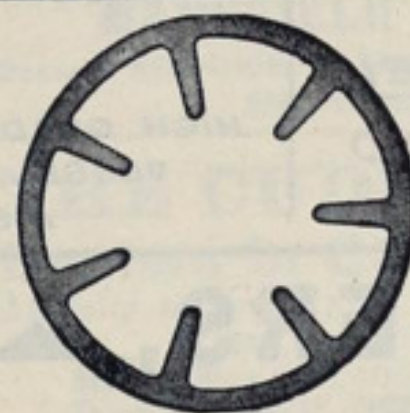


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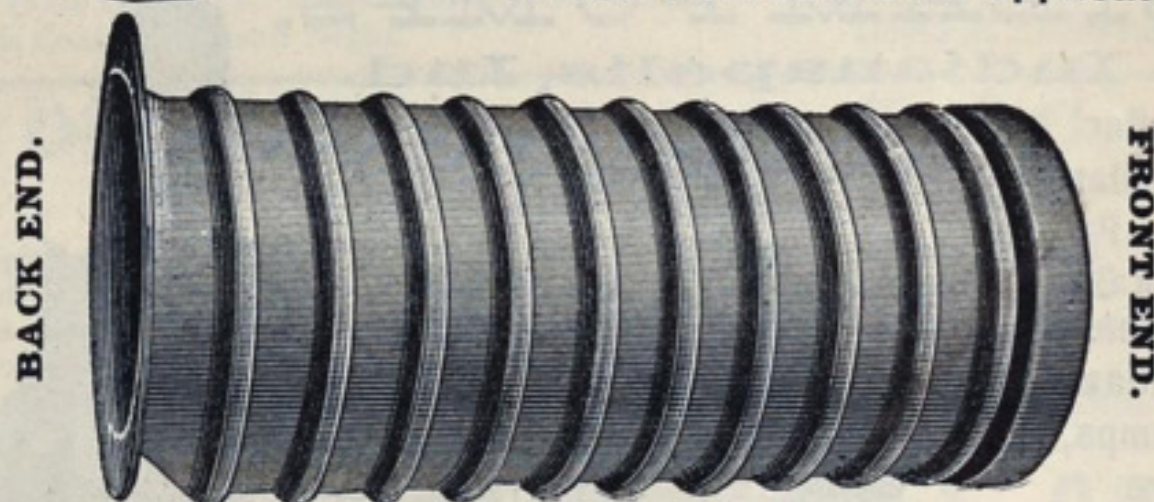
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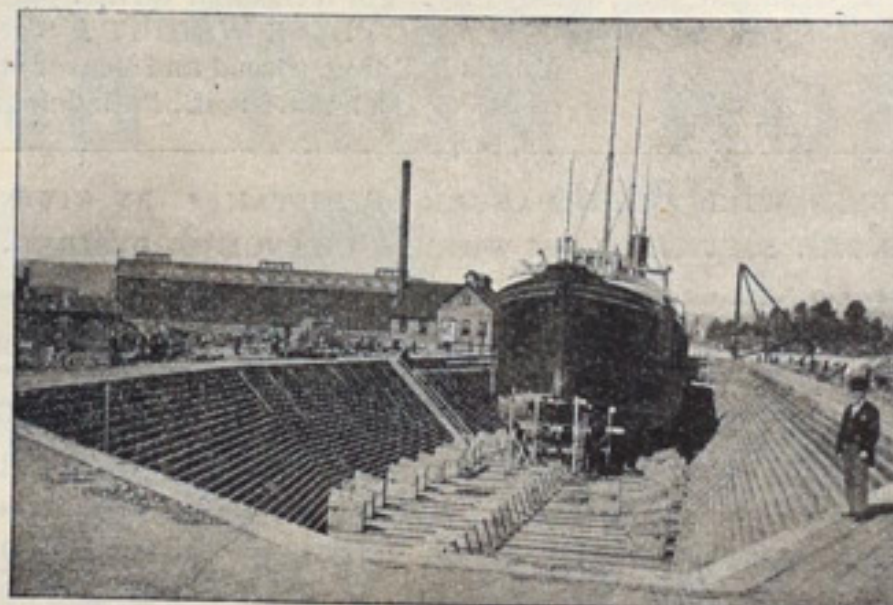
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